CCS News Bytes

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Maya Gokhale's Book to Appear in September

September 2005 should be a memorable month for Maya Gokhale of CCS-1: Her first book, "Reconfigurable Computing: Accelerating Computation with Field Programmable Gate Arrays," should appear during that month.

The 235-page book, written with co-author Paul S. Graham, will be published by Springer-Verlag, a scientific publishing company with a long and respected history.

Asked about the term "reconfigurable computing," Gokhale said she was part of a research team that built one of the first two "reconfigurable computers" and "coined the term." (She reached up to one of the top shelves in her office and brought down one of the first reconfigurable computing boards.) The title of the book refers to using programmable hardware to do high-performance computation, she said.

Field programmable gate arrays (FPGAs) are integrated circuits—combining logic and memory—that can process digital information. Because they can be reprogrammed after their manufacture, they resemble microprocessors. But because they can map algorithms directly into programmable logic, they can deliver a 10-fold or 100-fold performance increase over microprocessors.

FPGAs are used in many places at Los Alamos National Laboratory. The Los Alamos Neutron Science Center (LANSCE) uses FPGAs to do data acquisition.

The International, Space and Response Division (ISR) plans to put nine FPGAs on a signal-processing satellite scheduled to be launched within six months.

And in the Computer and Computational Sciences Division (CCS), Gokhale said, "We have a Cray reconfigurable computer that has six FPGAs"—one for each of its six Opteron nodes. Scientists can load different programs into the Opteron's memory and different configurations into the FPGAs.

(Please see GOKHALE on Page 2.)

Cindy Sievers of CCS-1 (standing), Krystal Atkinson (at left), and Susan Meyers (at back) monitor an Access Grid® presentation.

Access Grid® Opens New Window to World

By Charmian Schaller

The Access Grid® node that Cindy Sievers of CCS-1 maintains in Room 115 at Building 200 looks like a simple classroom with one large, blank wall—but when the correct connections are made, it can be a window to the world.

The Access Grid® website provides a simple explanation of this five-year-old tool: "The Access Grid® is an Internet-based conferencing system supporting real time, multipoint, group-to-group communication and collaboration. It consists of multimedia displays, interactive presentation software, and interfaces to visualization environments. The Access Grid® substrate is the Internet, using IP multicast and middleware to feed the nodes."

(Please see ACCESS GRID on Page 3.)

GOKHALE (Cont'd from P.1)

The use of reconfigurable computing "allows you to make changes to algorithms you have previously put on the FPGA," she said, "but also to devise completely new algorithms." For that reason, it is especially useful in satellites.

Seeing the book published in September will bring a satisfying close to a year of intense effort. Gokhale and Graham (a scientist in ISR) began work on the book in September 2004. They finished writing it in April 2005. The work related to publishing the book has been in progress since that time.

Maya Gokhale of CCS-1 holds one of the first reconfigurable computing boards.

Gokhale had done chapters in books before, and she had given tutorials on reconfigurable computing, but this was her first book. It was actually her work gathering materials for tutorials that helped her realize that there was really no comprehensive book on the subject. She waited two years and finally decided she would have to do one herself.

"I was fortunate enough to get Paul as a co-author," she said, noting that he has a Ph.D. from Brigham Young University, where he worked very intensively on reconfigurable computing in conjunction with his doctoral research.

"In order to get a publisher," Gokhale said, "I developed a detailed outline of the book. Since I have been in the field for 15 years, I knew what the topics should be." She had hoped that she and Graham would do the computer science chapters and get contributed chapters on applications, but in the end, only two of the book's nine chapters were contributed by application experts.

She paused during the interview to give credit to Reid Porter of ISR-3, an expert on image processing; Dominique Lavenier and Mathieu Giraud of the Institut de Recherche en Informatique et Systemes Aleatoires at Rennes, France; and two papers by Los Alamos authors Christine Ahrens, Jan Frigo, Justin Tripp, Anders Hansson, Henning Mortveit, Ron Minnich, and Gokhale herself.

"Initially," she said, "I just began writing and kept going, but as time went on and things were more structured, we did set goals for ourselves." The book was sent to the publisher in early April and presented in draft form at the June 13-17 Design Automation Conference in Anaheim, California.

"Writing is very difficult," she commented—and in addition to writing the book, she said, she and Graham did all the figures, the formatting, and the layout for the attractive orange volume.

When it came time to choose a publisher, she said, "I researched all the major publishers for science." She had talked with a representative for Kluwer three years earlier at the International Conference on Computer-Aided Design, and, after surveying the publishing field, she decided that Kluwer was the publisher she wanted. She called the representative she had met, but, "It turned out that Springer had bought Kluwer," so she went with Springer.

In general, she said, the authors' relationship with the publisher went smoothly. The publication schedule was delayed a little by the merger of Kluwer and Springer, but the book should be generally available in September.

Asked if she is excited about the book, she said, "Yes!" and added that her father, B.G. Gokhale—a professor emeritus in the history department at Wake Forest University who is the author of 17 books on Asian studies—is pleased too.

"The reason this book has come into existence and is such a comprehensive survey," she added, is because of the expertise at LANL. "I wanted to let people know that Los Alamos has this expertise."

Gokhale was born in India, but she was still a child when her father became a professor at Wake Forest in Winston-Salem, North Carolina. She has lived in the U.S. most of her life.

Her first degree was a bachelor-of-science degree in mathematics from Wake Forest, and she subsequently earned a master of science in engineering and a doctorate in computer science from the University of Pennsylvania.

(Please see MORE GOKHALE on Page 6.)

ACCESS GRID® (Cont'd from P.1)

But the potential of Access Grid® can only really be appreciated through individual experience.

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During the first week in August, SIGGRAPH2005, the 32nd international conference on computer graphics and interactive techniques, was held in Los Angeles. A number of Laboratory computer scientists attended SIGGRAPH2005—and Access Grid® took a bow. It was one of the hot new ideas featured on SIGGRAPH's "Emerging Technologies Venue."

In Los Alamos, Sievers invited all interested Laboratory employees to come to the node in Building 200 and experience the Access Grid® presentations, which focused on the arts.

On August 1, I sat in her little classroom and watched people assemble in 12 widely scattered sites in the United States, England, and Canada. Images from each "node" appeared on the blank wall in the room. I could see people waiting patiently for the program to start. I could watch students laughing at the University of Maine. I could even see myself, sitting in Los Alamos, watching images being assembled on the wall—and trying an experimental wave.

In Los Angeles, Roy Ascott began talking about art and the program to come. He introduced people at his location—and the screen widened and showed them as he pointed to them.

Peter Anders, author of a Ph.D. dissertation on "Integration of Physical and Virtual Spaces in Design," came to the podium and began speaking. I turned to Sievers, who was seated at a computer screen in the back of the room, and asked if she had a list of speakers from which I could get proper spellings, titles, and subjects. Within seconds, she posted a list on the wall in front of me—along with the other images.

Anders began speaking about glass windows in his house and reflections that gave the illusion that his living room extended into the back yard. He discussed how such phenomena have been used through history for "rather spooky and occult purposes," and, as he gestured toward his slides on display in Los Angeles, the slides appeared on the wall in Los Alamos. He shared a "ghost-like apparition" sitting on a sofa; a collection of devices ranging from mirrors to crystal balls—some left behind by the ancient Egyptians; and an etching of witches staring into a cauldron.

Cindy Sievers shows where an audience member might choose to sit while watching an Access Grid® presentation that features many live screens—potentially transmitted simultaneously from many different locations.

Twenty-seven minutes into the Access Grid® program, Anders was talking about the witches in Shakespeare's "Macbeth" and how they might have peered into bubbling pots in which baboon's blood was used to still the surface of the water. He spoke of the "strong sense of theater" associated with "transparent reflection" during the Middle Ages.

I looked around my own little "theater" and counted 16 screens lighting up the previously blank wall.

Anders concluded his talk, discussing the rise of a more rational view of light effects, mentioning holography, and discussing how artists and designers today can learn from the "magical" tricks of the past.

Other speakers took their turns at the podium in Los Angeles. The presentation wasn't perfect. Part way through the second talk, Sievers announced, "We're experiencing some network loss from Los Angeles." Those of us in the multicountry audience waited, while Los Angeles worked out its problems. The students in Maine held up a magazine for the camera to appreciate. People at other sites looked a little grumpy ... but then we were back.

One of the speakers showed a video clip that featured sound from one site, flashing lights from another, and two dancers at a distance. Music, lights, and dance were brought together in the speaker's videoclip—which could be seen at all of the sites connected by Access Grid®.

(Please see MORE GRID on Page 6.)

The Annual CCS Picnic

July 27, the date of the 2005 Computer and Computational Sciences Division Annual Picnic in Urban Park, turned out to be warm and sunny. Lots of people came to enjoy good food and good company.

The photo above shows the scene from the sidewalk. In the picture at right, Deputy Division Leader Stephen Lee, a portrait in determination, pumps out burgers in spite of the smoke. The photo at right below shows Executive Office Administrator Becky Fernandez (in sunglasses), the organizer of the event, chatting with Tabitha Valdez.

On the next page, clockwise from top left, Division Leader Bill Feiereisen and Ron Minnich balance food and conversation; the first few people size up the fruits and desserts; CCS-2 Group Leader John Turner takes his turn at the grill; a hungry crowd chooses buns and salads; and Mark Petersen's wife Kimberly and son Theodore pause for the camera.

Sunshine, Good Food, and Friendly Conversation

Photos by Charmian Schaller

MORE GRID (Cont'd from P.3)

Several of the speakers pointed out the value of being able to see and build on each other's work—without ever leaving home.

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In an interview later, Sievers said that use of the Access Grid® is growing.

She gave several examples of groups that have used the grid in recent months.

- High-Productivity Computing Science (HPCS), a national group formed recently, is meeting now over the Access Grid®. About 20 sites are involved in these meetings.
- Open MPI (Message Passing Interface) recently started using Access Grid®.
- And the Earth Systems Grid (ESG)—which includes six or seven sites including Argonne National Laboratory, Lawrence Livermore National Laboratory, the National Center for Atmospheric Research, and Oak Ridge National Laboratory—is meeting weekly on Access Grid®. Matthew Hecht, a Los Alamos scientist doing climate-modeling in CCS-2, is one of the scientists involved in ESG.

"We've done collaborative education over the grid," Sievers said. "Jim Morel, formerly of CCS-2, taught radiation transport on the grid," reaching both local and remote students, including some from Sandia National Laboratories and some from the University of New Mexico.

"We're building a new Access Grid® node over at the Research Park," Sievers said, adding that she hopes classes there will start in January.

She pointed out, "The Access Grid® is not just a videoconferencing tool. We can share data over the grid," including material on desktops, PowerPoint presentations, and browsers. Within the grid's global community, she said, applications are being written to address needs of users ranging from shared white boards to high-definition television.

The Access Grid® has web pages at http://www.ccs.lanl.gov/ccs1/projects/accessgrid. Open presentations are free for all Laboratory employees.

Those who want to use Access Grid® for a meeting may call Sievers at 665-6602. It's wise, she noted, to call a week in advance. "It's getting busy," she said.

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MORE GOKHALE (Cont'd from P.2)

Her thesis was on very-high-level programming languages compiled for data-flow machines.

Her employment background reveals her interest in both academia and industry.

She finished her first degree in three years, graduating at 20, and found that she felt "burned out." As a result, she went to work for Burroughs, and, subsequently, for Hewlett-Packard Co. "I really enjoyed working in the 'real world,'" she recalled with a smile.

Eventually, however, she returned to school and got her graduate degrees.

She taught computer science for five years at the University of Delaware—and also had two children while she was there. It was a very demanding time, she said. She was just preparing a tenure dossier when she found that she had an opportunity to join the Supercomputing Research Center (now the Center for Computing Sciences, an Institute for Defense Analysis Center) in Bowie, Maryland.

"I had always been interested in massively parallel computing and high-performance computing," she said. She seized the opportunity and joined a project called "Splash," a new project that had started at the Supercomputing Research Center. "The intent was to use FPGAs as parts of high-performance computers," she said. "I developed a computer-aided design tool to program Splash, and algorithms were actually implemented for this machine. It won honorable mention for a Gordon Bell Prize for price/performance, and it was used for doing computing for certain problems in the first Gulf War." She has a plaque in her office displaying a citation and an "intelligence community seal medallion."

During her time at the Supercomputing Research Center, she also worked on "processing in memory," a procedure that involved embedding processors on a SRAM (static random access memory) chip. She designed a language and implemented a compiler to program these PIM (processor-in-memory) chips.

Eventually, she moved (with a couple of members of her old team at the Supercomputing Research Center) to Sarnoff Corp. in Princeton, New Jersey, where she worked on a number of projects.

(Please see BOOK on Page 7.)

BOOK (Cont'd from P. 6)

One of them was an SIMD (single instruction multiple data) machine for video on demand. Another was a processor plus an FPGA on a single chip (and she designed a compiler specifically for this hybrid architecture).

Her next move came, she said, when "my husband and I were recruited to come to Los Alamos."

"I came to what was then NIS (the Nonproliferation and International Security Division, which became ISR) to work on reconfigurable computing," she said. She stayed in ISR for about six years, leading a team on reconfigurable adaptive systems. She actually finished her book there. "We were able to do the book because of funding from a Laboratory-Directed Research and Development-Directed Research (project) on 'Scalable Reconfigurable Computing,'" she said.

In the spring of 2005, however, she moved to CCS-1 (the Advanced Computing Laboratory), joining her husband, who works on the cluster operating system in the group.

This year, she and her husband, Ron Minnich, have a rather remarkable "Laboratory family." Their son, Austin Minnich, who will be a senior in mechanical engineering at the University of California-Berkeley (UC-Berkeley) this coming fall, is working in the Theoretical Division (T Division) in the Center for Non-Linear Studies (CNLS) this summer. Their daughter, Amanda, who will be a freshman at UC-Berkeley this fall in the College of Chemistry, is working in the Bioscience Division (B Division).

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Meet Our New People

Benjamin K. ("Karl") Bergen, soon to be a new postdoctoral researcher in the Continuum Dynamics Group (CCS-2), has an interesting background that ranges from philosophy to mathematical modeling.

Bergen was born in Atlanta, Georgia, and earned his bachelor-of-arts degree in philosophy from Emory University in Atlanta in 1993.

His first job took him to a new location and a new specialty. He went to work for Green Mountain Geophysics in Boulder, Colorado, as a software developer.

In his next position, with Stellacore Corp., in Parker, Colorado, he served as a software developer in photogrammetry and did contractor work for Zeiss Optics, writing software to do conversion and manipulation of aerial and satellite photos.

Benjamin Bergen

He returned to school at the University of Colorado in Boulder and earned a master-of-science degree in applied mathematics.

His next stop was in Germany, where he attended Friedrich-Alexander University in Erlangen, became fluent in German, and studied computational engineering. His degree in computational engineering, the equivalent of a Ph.D. in the United States, is pending. He has completed a thesis on "Hierarchical Hybrid Grids: Data Structures and Core Algorithms for Efficient Finite Element Simulations on Supercomputers."

He has been in Los Alamos twice before as a graduate research assistant (GRA), working both times for the Mathematical Modeling and Analysis Group (T-7).

After his second time here, he found himself attracted to the community and to Los Alamos National Laboratory, partly because of his love for mountain biking, hiking, fishing, and skiing.

He joined CCS-2 on July 25, 2005, and is now working on radiation hydrodynamics.

(Please see BERGEN on Page 8.)

BERGEN (Cont'd from P. 7)

He is expected to be a postdoc soon, but because he still must defend his thesis, he is technically still a GRA.

He is single and has no family in New Mexico, but he has a girlfriend who is attending school in Cologne, Germany, and might join him here in the future.

Asked about his favorite activities in his spare time, Bergen said, with a grin, "My thesis has been my hobby for a long time," but he also enjoys "programming and playing with Linux." Among his additional interests are physics, cosmology, and … yes… philosophy.

And how does philosophy fit in with mathematics and computer science? It "teaches critical thinking," he said.

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In Case You Missed It….

The Division Review Committee Report has been released, and there were no surprises. The report's executive summary included several paragraphs that were very complimentary to CCS. They are worth repeating:

"The Computer and Computational Sciences (CCS) Division Review Committee finds that the Division has continued to make enormous progress. As in past years, the DRC was impressed by the quality of the research conducted by CCS, the transfer of new technologies to laboratory practice, and the increased engagement by CCS with other divisions. We commend the division for its diligence and commitment to research excellence and laboratory engagement.

"CCS has made critical contributions to laboratory weapons milestones. These include technology transfer to production at Los Alamos (X, CCN, and MST Divisions and IBM have been beneficiaries), timely response to national security needs, and institutional computing expansion. The work on implicit Monte Carlo (IMC) techniques was a strong response to an urgent laboratory need. Similarly, the deployment of Clustermatic infrastructure has had a major impact on the laboratory's production computing, saving Los Alamos a great deal of money and fostering an industry move to Linux for high-end computing. The work on Capsaicin and mesh-free Lagrangian hydrodynamics is very innovative, and the DRC believes this long-term research effort is beginning to bear great fruit. Finally, the work on VTK and incremental visualization techniques for large data sets will be increasingly important as the laboratory moves to petascale computing."

The report also said, "The DRC believes the performance of CCS should be rated *Outstanding*, with a numerical score of 3.5. This is a notable improvement relative to 2004, based on interactions with X and CCN divisions as well as CCS' own research and development accomplishments."

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CCS has lost its division security officer—but Bonnie Davenport left for a great reason.

She is the new group leader of Information Security (S-11).

She has agreed to fill in as much as she can until her CCS replacement is chosen. (The job has been posted.)

Nehal Desai in CCS-1 has volunteered to take over her role as the CCS point of contact for the Center for Homeland Security on technical cybersecurity.

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Several other people are leaving. We wish them all the best of luck.

Fabrizio Petrini in CCS-3 is leaving to take a job at Pacific Northwest National Laboratory. Ralph Castain in CCS-1 is joining the Center for Homeland Security. Denis Dimick of CCS-1 is joining the Theoretical Division. Monica Trujillo, the CCS-1 group administrator, is joining the Supply Chain Management (SUP) Division Office. Tabitha Valdez has left the CCS-3 Group Office to join the Manufacturing Systems and Methods (MSM) Division Office. And Norma Escobedo has left the CCS Division Office and will also be joining MSM. Angela Martinez from the Plus Group will be working in CCS-DO until a replacement for Escobedo is selected.

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August 4 was a good day for CCS in the Laboratory's Daily News Bulletin. One of the stories was about CCS-1's Access Grid®.

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